FORMER NCBC DAVISVILLE

77th Restoration Advisory Board (RAB) Meeting Minutes

September 23, 2010

The 77th Restoration Advisory Board (RAB) meeting was held at the Quonset Development Corporation (QDC) Conference Center at 95 Cripe Street in North Kingstown, Rhode Island on 23 September 2010. The meeting agenda for the 77th RAB is included as Attachment A. The attendance list for the 77th RAB is included as Attachment B. David Barney, the Navy's BRAC Environmental Coordinator, convened the meeting at approximately 7:00 PM on 23 September 2010.

NEXT RESTORATION ADVISORY BOARD MEETING

The next RAB meeting will be held on 17 March 2011 at 7:00 PM at the QDC Conference Center. The Navy will send out postcards prior to the next RAB meeting reminding the public of the date, time, and location of the next meeting.

LONG-TERM MONITORING UPDATES

Steve Vetere gave a brief update on long-term monitoring schedules:

Since the last RAB meeting, the Navy has completed the field work for the 32nd (April 2010) and 33rd (July 2010) quarterly monitoring events at Allen Harbor Landfill. The 34th event was ongoing at the time of the meeting. In March 2010, the Navy provided a draft data report to stakeholders for the 31st event (January 2010) and in June 2010 the Navy provided a draft data report for the 32nd event. The data report for the 33rd event will be submitted in October 2010. The next monitoring event will be in December 2010. Work on the revision/optimization of the long-term monitoring program for Allen Harbor Landfill is ongoing.

Monitoring Event 14 at Calf Pasture Point was initially planned for October 2010. This event was postponed until spring 2011. Instead, the Navy and EPA have plans to conduct supplemental investigations at Calf Pasture Point in order to strengthen the conceptual site model. The Navy's work plan for this investigation is due to EPA and RIDEM at the end of September.

SITE 16 FEASIBILITY STUDY UPDATE

Steve Vetere provided a brief summary of the field investigations completed by the Navy during the spring and summer to provide additional data with which to evaluate potential remedial options for Site 16:

- 65 new test pits were advanced in NorthCentral Area (NCA)
  - Debris field is larger than previously known. It is not confined to the northwest quadrant.
  - PAH/lead contamination is somewhat more extensive than previously assumed.
- 9 new soil borings were advanced along the southern sidewall area of former Building 41. Soil samples collected from these borings are currently being analyzed so data are not yet available.
- 10 new soil borings were advanced at the eastern end of former Building 41. Initial lithological interpretations and sample analytical results confirmed our understanding of VOCs at that end of the building. No significant new sources were found and the conceptual site model was verified.
- 4 new permanent monitoring wells were installed:
  - 2 at BTEX hotspot – one shallow and one intermediate depth
  - 2 at SeaFreeze area near Narragansett Bay edge – one shallow and one intermediate/deep

    - Trichloroethene (<50 µg/L) detected in the intermediate depth wells
    - CSM confirmed
- 11 new soil gas/borings/shallow temporary monitoring well locations were advanced:
    - 5 near two NORAD buildings
    - 5 near SeaFreeze
    - 1 location between NORAD and SeaFreeze
    - All 11 shallow temporary monitoring wells converted to permanent monitoring wells for continued monitoring
- 6 surface water/sediment/shallow groundwater samples were collected in Allen Harbor. This data is currently being analyzed but initial review shows data to be consistent with the CSM.
- Well development was completed at approximately 50 wells
    - 7 upgradient wells completed at request of EPA
    - Approximately 30 existing wells re-developed
    - 4 new monitoring wells and all 11 temporary wells were developed
- Groundwater samples were collected from approximately 30 wells for VOC analysis and natural attenuation parameters.

By next spring, the Navy will have submitted a data report summarizing the field investigations described above and a Draft Final Feasibility Study for Site 16. During the next meeting, the Navy will be able to make a presentation on the revised Feasibility Study.

EPA PRESENTATION

The Strategic Environmental Research and Development Program (SERDP) is the Department of Defense's (DoD) environmental science and technology program, planned and executed in partnership with the Department of Energy (DOE) and the Environmental Protection Agency (EPA), with participation by numerous other federal and non-federal organizations. SERDP has funded a research project to evaluate field-scale approaches to the characterization of contaminated sites with dense non-aqueous phase liquid (DNAPL). The objective of the study is to evaluate field data from several sites in an effort to develop a relationship between DNAPL source areas and downgradient plumes so that models can be developed to predict long-term plume behavior. Mike Annable (University of Florida), Lynn Wood (EPA), Michael Brooks (EPA), and Gordon Brown (EPA) gave a presentation describing the project and the types of information that will be collected from Calf Pasture Point in the coming months to meet the objectives of the study (see Attachment C). The data collected during these investigations will also be used by the Navy, EPA, and RIDEM to refine the CSM and evaluate the potential benefit of source area treatment at Calf Pasture Point.

Calf Pasture Point is one of 20 field sites selected by SERDP for their study. Calf Pasture Point was a strong candidate for this study because of the presence of DNAPL, the heterogeneous nature of the geology, and because it provides an example of a DNAPL release that has been well characterized but has not been subject to remediation. In other words, the dissolution of DNAPL from the source area has not been “disturbed” by remedial actions.

The research team reviewed and analyzed historical groundwater sampling data for Calf Pasture Point. The first step of the study was to develop a “source-strength function” for the source area at Calf Pasture Point using historical site data. The source-strength function is the mass discharge of contamination from the source zone as a function of time. The research team selected a source zone control plane consisting of monitoring wells MW07-04D, MW07-05D, and MW07-17D to estimate the source-strength function for Calf Pasture Point. Once the source zone control plane was established, the next step was to estimate the mass discharge per unit time across this plane. Mass discharge was estimated using historical groundwater sampling data and an estimate of groundwater flow velocity. Historical data are plotted on a time scale and fit to a power law model to develop a function.

Preliminary calculations using historical data from Calf Pasture Point suggest the site is 97 percent “old”, meaning that approximately 97 percent of the mass of DNAPL released at the site has been dissolved in groundwater and is now part of the dissolved plume (or bound to organic matter in the soils). In other words, only approximately 3 percent of the mass of VOCs at Calf Pasture Point are believed to be in the form of DNAPL.

The source-strength function may also provide information with which to model the behavior of a DNAPL source area. Using the Remediation Evaluation Model for Chlorinated Solvents (REMChlor), the team hopes to model the behavior of the Calf Pasture Point plume in an effort to evaluate whether source area remediation would be beneficial.

Additional information needs to be collected in order to mitigate some of the uncertainty associated with this model. The team intends to collect groundwater samples from monitoring wells located in the source area. The Navy, as part of its Source Area Investigation, will advance soil borings within the source area and collect soil borings for VOC and organic carbon analysis.

During the next RAB meeting, the research team will have completed sampling at Calf Pasture Point and will have additional data with which to refine the source-strength function.

Tonight’s meeting concluded at approximately 8:15 P.M.

ATTACHMENT A

23 SEPTEMBER 2010 RAB MEETING AGENDA

AGENDA
FORMER NCBC DAVISVILLE
77th Restoration Advisory Board (RAB) Meeting

Date: September 23, 2010
Time: 7:00 P.M.
Location: 95 Cripe Street, North Kingstown, Rhode Island

RAB Meetings – Next Meeting Date

Long-Term Monitoring Program Updates

- Site 09: Allen Harbor Landfill
- Site 07: Calf Pasture Point

Site 16 Feasibility Study Update

EPA Presentation – Calf Pasture Point

ATTACHMENT B

23 SEPTEMBER 2010 RAB MEETING ATTENDANCE LIST

FORMER NCBC DAVISVILLE
RAB MEETING ATTENDANCE LIST
23 SEPTEMBER 2010, 7:00 PM
95 CRIPE STREET – QDC CONFERENCE CENTER

Name	Affiliation	Phone	email
STEPHEN VETERE	TETRA TECH	(978) 474-8444	stephen.vetere@tetratech.com
DAVE BARNEY	USNAVY	617 753 4656	david.a.barney@navy.mil
RICH GOTTLIEB	RIDEM	401-222-2797 x 7138	richard.gottlieb@dem.ri.gov
Bryan Olson	US EPA	617-918-1365	OLSON.BRYAN@EPA.GOV
BILL BRANDON	USEPA	617-918-1391	brandon.bill@epa.gov
Jack Walsh	QDNYC	401 503 7093	JohnWalsh21@verizon.net
CHRIS COURTNEY	QDNYC	401-884-8542	CFCOURTNEY@VERIZON.NET
STEVEN KING	QDC	401-295-0044	SKING@QUONSET.COM
Mike Annable	U of Florida	352-392-3294	annable@ufl.edu
Lynn Wood	USEPA/ORD	580-436-8552	wood.lynn@epa.gov
Susan Licardi	NKH2O	401 268-1520	slicardi@northkingstown.org
ED TURNER	SEABEE VETS	401 884-1929	CBETX1DV@COX.NET
Gordon Brown	USEPA/ORD	(580) 436 8665	brown.gordon@epa.gov
Peter Elleman	Resident	401-294-6424	pelleman@cox.net
Michael C. Brooks	OSEPA	580.436.8982	brooks.michael@epa.gov

ATTACHMENT C

23 SEPTEMBER 2010 RAB MEETING PRESENTATION SLIDES

PREDICTING DNAPL SOURCE ZONE AND PLUME RESPONSE USING SITE-MEASURED CHARACTERISTICS

Project Number (ER-1613)

September 23, 2010

Project Team

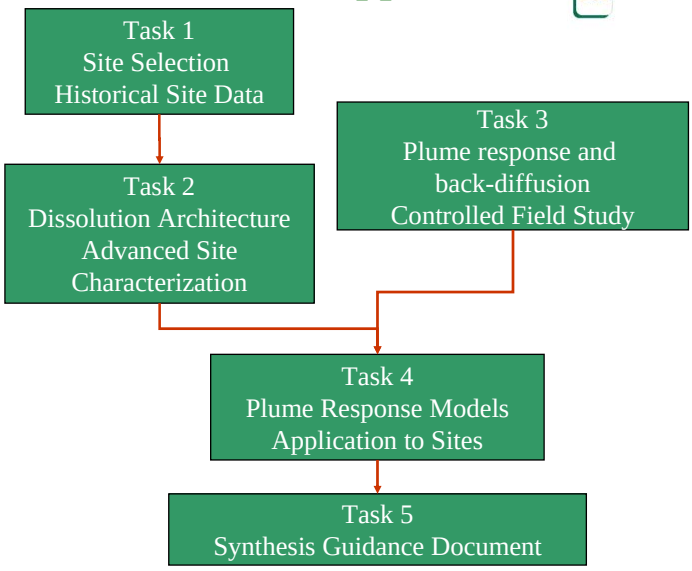
- Dr. Michael D. Annable
  University of Florida
  Expertise: Source zone and contaminant flux characterization
- Dr. Michael C. Brooks
  EPA, Kerr Research Center
  Expertise: Innovative site characterization techniques
- Dr. Kirk Hatfield
  University of Florida
  Expertise: Innovative site characterization, modeling
- Dr. James W. Jawitz
  University of Florida
  Expertise: Contaminant transport modeling, DNAPL characterization
- Dr. P. Suresh C. Rao
  Purdue University
  Expertise: Modeling/Synthesis, Site characterization & remediation
- Dr. A. Lynn Wood
  EPA, Kerr Research Center
  Expertise: Site characterization and remediation

Technical Objective

This project proposes to demonstrate effective field-scale approaches that forge linkages between characterization, prediction, and decision making at DNAPL sites.

- Develop source-strength functions based on existing historical site data supplemented with flux- and core-based sampling;
- Extend to the field-scale our ability to predict DNAPL source depletion through dissolution, based on *a priori* characterization;
- Characterize the near-source plume response to source-mass depletion;
- Link characterization of near-source, short-term responses to long-term behavior
- Provide recommended guidance on the level of source-zone characterization needed to determine source-strength functions and plume response.

Technical Approach



Task 1. Predicting DNAPL dissolution from historic data

- 20 field sites selected for historical site data analysis.
- A larger number of secondary sites than originally planned is to assure a good selection of site complexity and data sufficiency
- Plan to consider additional sites for inclusion in historical data analysis and looking for another primary site (currently 3 in bold)

	DNAPL sites selected for SERDP project	Contaminants
DoD Sites	**Hangar K Cape Canaveral FL**	TCE/cDCE/VC
	Tinker AFB Oklahoma	TCE/byproducts
	Hill AFB OU-2	TCE
	EGDY Ft. Lewis, Washington	TCE
	NTC Orlando SA17	TCE/cDCE
	NAS Jacksonville	PCE/TCE/cDCE/VC
	Arnold AFB Tennessee (SWMU 10)	TCE/byproducts
	NAS Pensacola SWMU 1 (WWTP)	TCE/cDCE/VC
	NSF Indian Head Site 57	TCE/cDCE/VC
	Confidence Course Cape Canaveral	TCE/byproducts
	Site 07, Calf Pasture Point, Naval Construction Battalion Center	1,1,2,2,-Tetrachloroethane
	Paris Island, SC	PCE
	Alameda NAS	TCE
International Sites	CFB Borden Ontario (controlled release)	PCE/TCE/MTBE
	Edinburg, Adelaide, Australia	TCE/byproducts
	Belmont Site, Perth	Brominated compounds
Industrial Sites	Sages Drycleaner	PCE/byproducts
	Chevron Site Richmond CA	TCE
	BP Site Los Angeles CA	TCE
	Drycleaner Site, Lodi CA	PCE

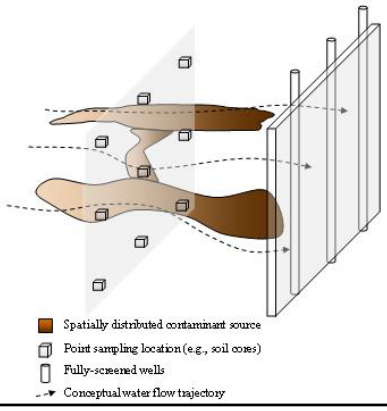
Technical Approach

Task 2. Predicting DNAPL dissolution based on measured architecture

From the list of secondary sites three have been identified for **advanced characterization** of the DNAPL architecture including:

- Source zone mass (m) through high-resolution DNAPL saturation characterization using cores, $S_n(x,y,z)$ (10-20 borings with 0.2 m sampling interval).
- Trajectory-integrated DNAPL saturation employing a small-scale reactive tracer test
- Mass flux measurements $J(x,y,z)$, and mass discharge M_D at a source zone control plane.

Primary Sites	**Field Support**
Alameda CA	SERDP / Navy
Hangar-K FL	SERDP / Air Force
Industrial Site Perth WA	Site Owner

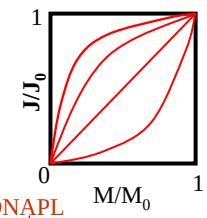


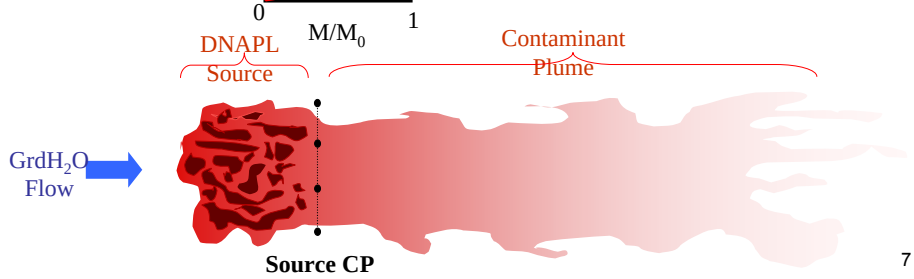
Task 5. Synthesis

Through the results of Tasks 1-4, we propose to develop recommended site characterization strategies that provide adequate data to define a source-strength function to predict plume responses for site management decisions.

A guidance document will be produced which focuses on site assessment needed to support site management decisions.

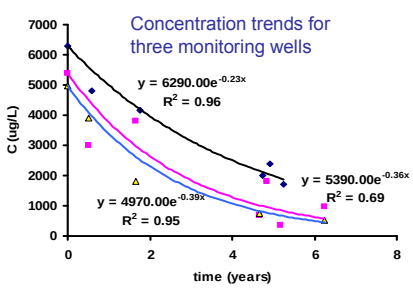
➢Source Function





Industrial Site, Australia

•*Predicting Source Strength Functions*



Method A:

$$M_{2006} = M_{1996}\exp(-10k)$$

$$= \left(\frac{qAC_{1996}}{k}\right)\exp(-10k)$$

M_{2006} **= present source mass**

1 to 10 kg

Source Mass Estimation

Method B:

$$M_P = \int_0^t M_{D,0}\exp\left(-\frac{M_{D,0}}{M_0}t\right)dt = 2250kg$$

$$M_{D,t} = M_{D,0}\exp\left(-\frac{M_{D,0}}{M_0}t\right) = 1kg/year$$

M_0 = 2,260 kg

t = 35-65 years

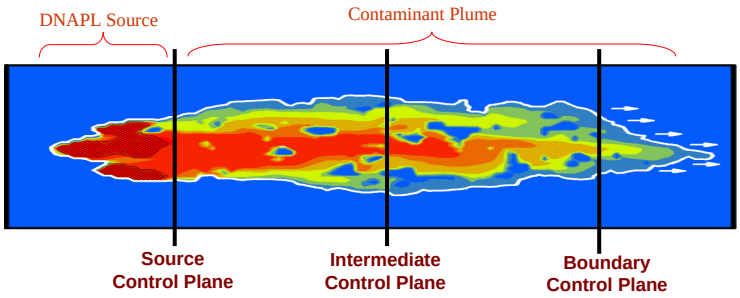
$M_{D,0}$ = 170–365 kg/yr

M_{2006} ~ 10 kg

CPP Historic Data Analysis

Estimate source-strength function from historic data

Source-strength function = mass discharge from source zone as a function of time.



CPP Historic Data Analysis

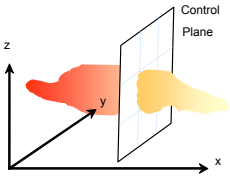
STEP 1: Establish a Source-Zone Control Plane

Location based on:

a) **wells with long-term monitoring data,**

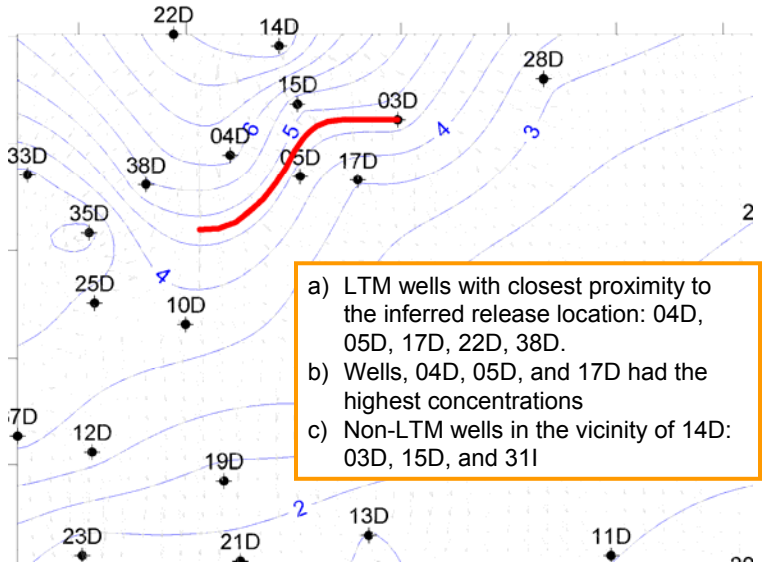
b) **the proximity of the wells to the inferred DNAPL release location, and**

c) **the location of the wells relative to the groundwater flow field.**



CPP Historic Data Analysis

Source-Zone Control Plane



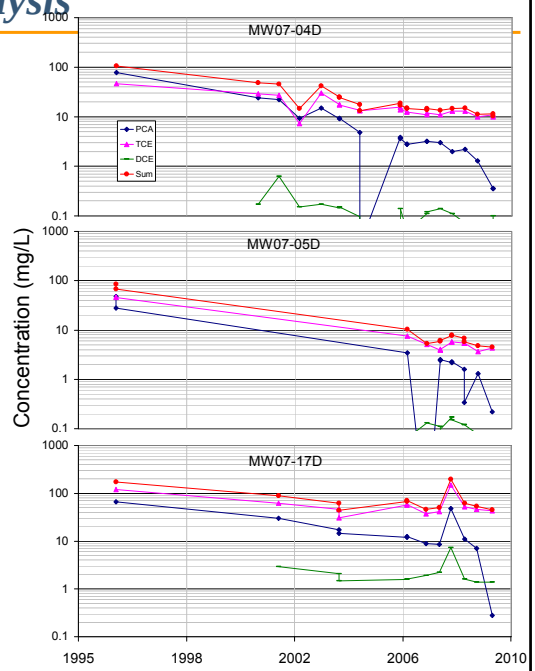
a) LTM wells with closest proximity to the inferred release location: 04D, 05D, 17D, 22D, 38D.
b) Wells, 04D, 05D, and 17D had the highest concentrations
c) Non-LTM wells in the vicinity of 14D: 03D, 15D, and 31I

CPP Historic Data Analysis

STEP 2) Source-Zone Control Plane Mass Discharge:

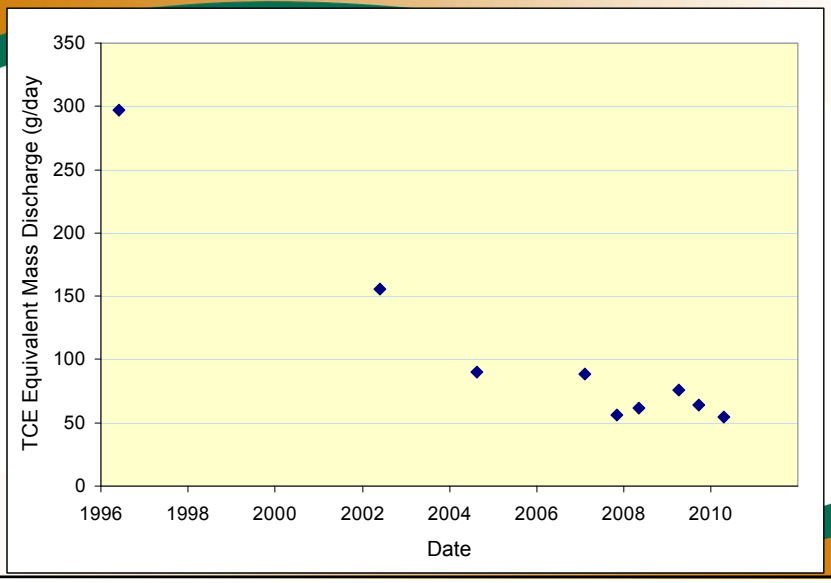
$$\dot{m} = \sum_{j=1}^{N} C_j * K_j * i_j * A_j$$

- *C* – LTM data
- *K* – Phase III RI report
- *i* – Analysis of average groundwater elevation
- *A* – SZCP Area



CPP Historic Data Analysis

Source Strength Function



CPP Historic Data Analysis

STEP 3) Model Fits, Power-Law Model

$$\frac{C_f(t)}{C_f(0)} = \left[\frac{M(t)}{M(0)}\right]^{\Gamma}$$

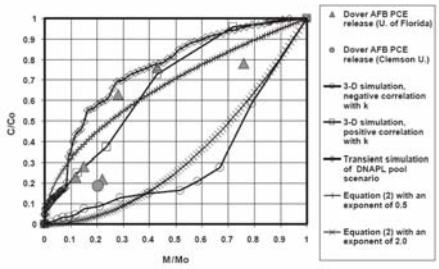
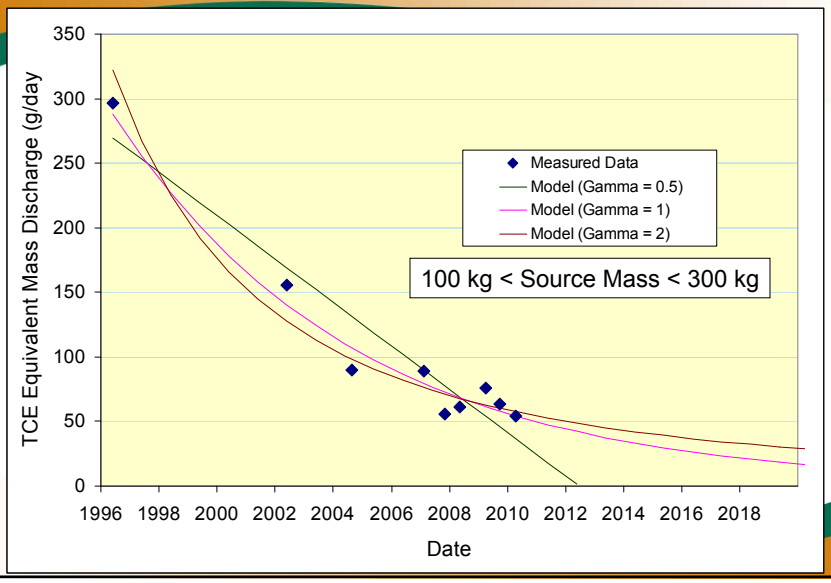


Fig. 1. Source zone dissolved concentrations as a function of source zone DNAPL mass.

Falta et al., 2005

CPP Historic Data Analysis

Source Strength Function



Preliminary results – Please do not cite or distribute

CPP – Significance of Source Zone?

- Site Age?
  - Age = Plume Mass / (Plume Mass + Source Mass)
    - Plume Mass ?
      - Accounting for sorbed mass using R = 7
      - Current Estimate ~13,000 kg < Plume Mass < ~22,000 kg
    - Source Mass?
      - 100 kg < Source Mass < 300 kg
  - CPP Site Age? >97%
- Source Longevity?
  - Assuming Gamma = 1
    - Half Life ~6 years
    - 90% in ~19 years
- REMCHLOR Screening-level simulations

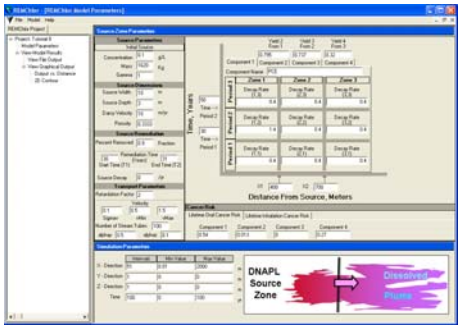
Preliminary results – Please do not cite or distribute

CPP Historic Data Analysis

REMChlor

Remediation Evaluation Model for Chlorinated Solvents

- Clemson University, Purdue University, EPA, CSMoS
- Analytical remediation model: Plume response linked to source remediation.



http://www.epa.gov/ada/csmos/models/remchlor.html or Google search for "REMChlor"

CPP Historic Data Analysis

REMChlor

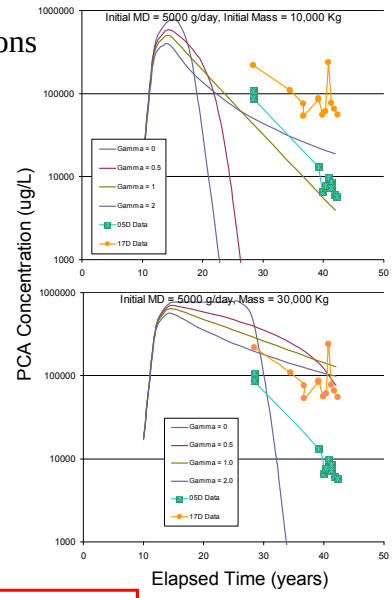
Remediation Evaluation Model for Chlorinated Solvents

NOTE: The following modeling results are shown as an illustration of the type of analysis that can be conducted using estimates of the source strength function. These results should not be viewed as predictions from a calibrated model.

CPP – Significance of Source Zone?

- REMCHLOR Screening-level simulations
  - Assume:

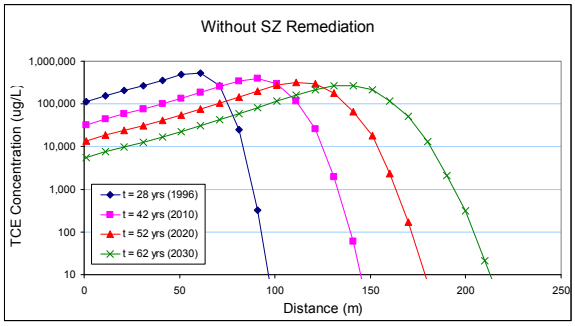
Parameter	Value
Flux-averaged concentration (g/L)	1.38
Initial mass (kg)	20,000
PLM Empirical exponent	1
Source width (m)	100
Source depth (m)	3
Darcy Velocity (m/yr)	4.4
Porosity	0.25
Retardation	7.2
Sigma_v	0.1
v_Min	0.5
v_Max	1.5
Alpha_y (m)	0.5
Alpha_z (m)	0.1
Lamda (1/yr)	0



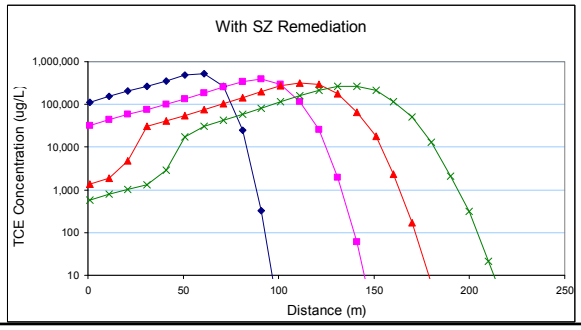
Preliminary results – Please do not cite or distribute

CPP - REMChlor Screening Evaluations

- No Source-Zone Remediation



- Source-Zone Remedation in 2010, with 90% source mass reduction



Preliminary results – Please do not cite or distribute

CPP Historic Data Analysis

All results subject to uncertainties

UNCERTAINTIES (Partial listing)

Extent of source-zone

Placement of source-zone control plane

Source-zone control plane well spacing

Vertical concentration distribution

Vertical groundwater velocity distribution

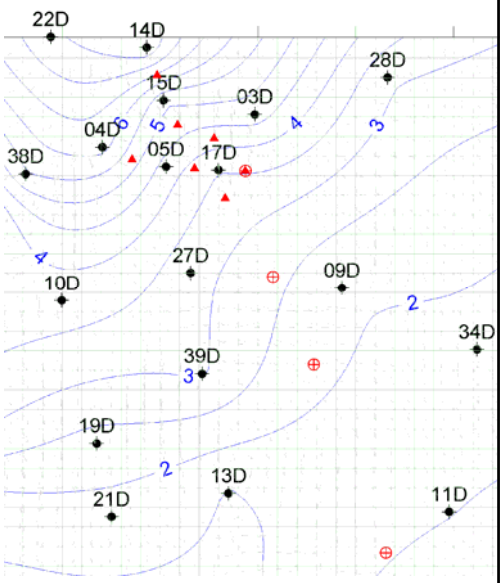
Estimates of retardation

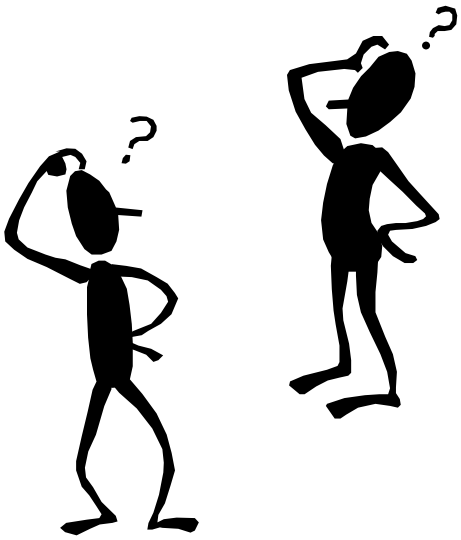
Plume Mass

Reduce uncertainties using additional data

Recommendations for Future Work

- Source-Zone Well Sampling
  - 03D, 14D, 15D, 31I
- Initial PFM Deployment
  - 04D, 05D, 15D, 17D, and 31I
- Soil Borings
  - Seven borings (triangles)
  - Field Screening by Navy Protocol
  - Sample for CVOC and FOC analysis
  - Collect sample for possible batch testing
- Second PFM Deployment
  - 03D(?), 09D, 27D, 34D, 39D, and four news wells (circles with cross)





Questions?